

## **Review: Modulating ruminal lipid metabolism to improve the fatty acid composition of meat and milk from ruminants. Challenges and opportunities.**

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### **Abstract**

Growth in demand for foods with potentially beneficial effects on consumer health has motivated increased interest in developing strategies for improving the nutritional quality of ruminant-derived products. Manipulation of the rumen environment offers the opportunity to modify the lipid composition of milk and meat by changing the availability of fatty acids (FA) for mammary and intramuscular lipid uptake. Dietary supplementation with marine lipids, plant secondary compounds and direct-fed microbials has shown promising results. In this review, we have compiled information about their effects on the concentration of putative desirable FA (e.g., *c9t11*-conjugated linoleic acid and vaccenic, oleic, linoleic and linolenic acids) in ruminal digesta, milk and intramuscular fat. Marine lipids rich in very long-chain n-3 polyunsaturated fatty acids (PUFA) efficiently inhibit the last step of C18 FA biohydrogenation (BH) in the bovine, ovine and caprine, increasing the outflow of *t11-18:1* from the rumen and improving the concentration of *c9t11-18:2* in the final products, but increments in *t10-18:1* are also often found due to shifts toward alternative BH pathways. Direct-fed microbials appear to favourably modify rumen lipid metabolism but information is still very limited, whereas a wide variety of plant secondary compounds, including tannins, polyphenol oxidase, essential oils, oxygenated FA and saponins, has been examined with varying success. For example, the effectiveness of tannins and essential oils is as yet controversial, with some studies showing no effects and others a positive impact on inhibiting the first step of BH of PUFA or, less commonly, the final step. Further investigation is required to unravel the causes of inconsistent results, which may be due to the diversity in active components, ruminant species, dosage, basal diet composition and time on treatments. Likewise, research must continue to address ways to mitigate negative side-effects of some supplements on animal performance (particularly, milk fat depression) and product quality (e.g., altered oxidative stability and shelf-life).

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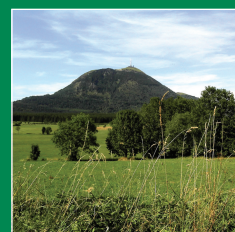
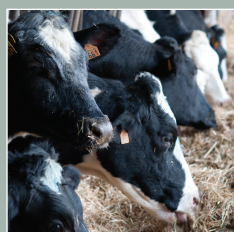
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